Μελέτες περίπτωσης ενεργειακής αναβάθμισης κτηρίων στην Κύπρο

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0. Lecture Structure

1. **Introduction – Renovation in Energy Efficiency of Buildings Directives**
2. **Best practices in the renovation sector following the implementation of EC 2002/91 in Cyprus**
3. **Further steps towards 2020 goals**
4. **Q+A**

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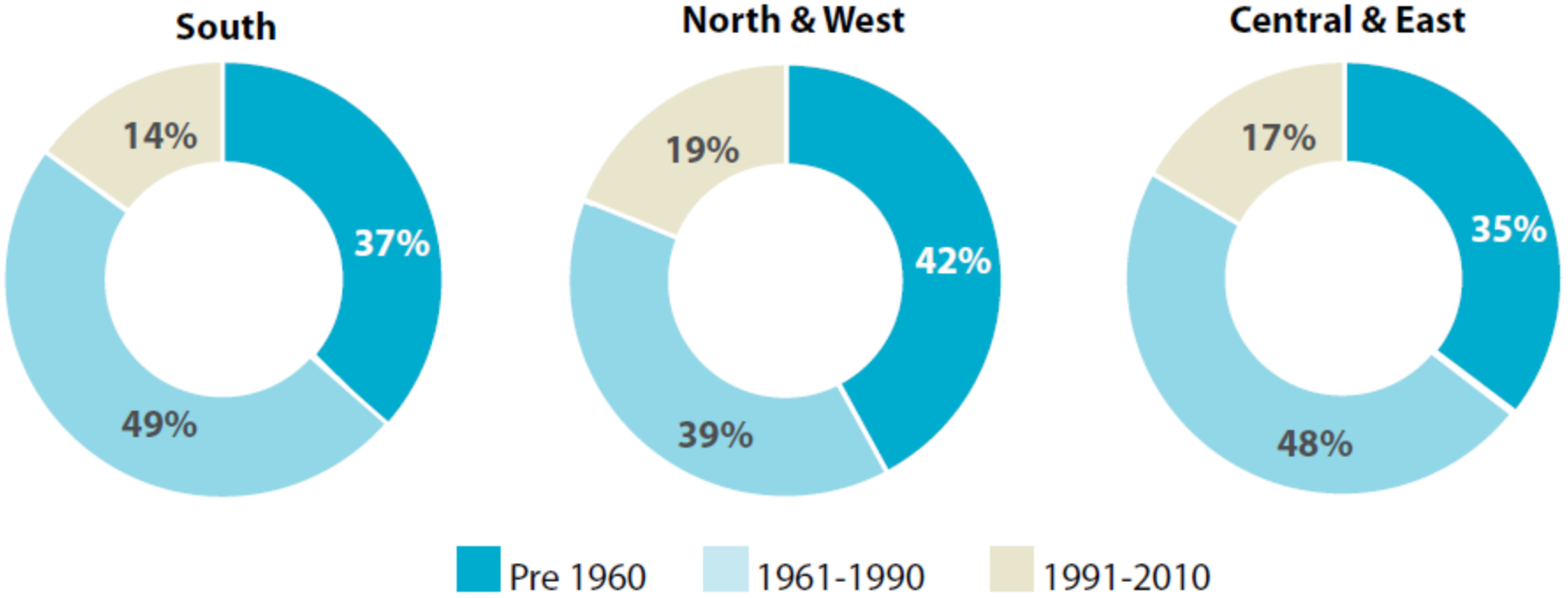
1. Introduction

Age categorisation of housing stock in Europe

Source: BPIE survey



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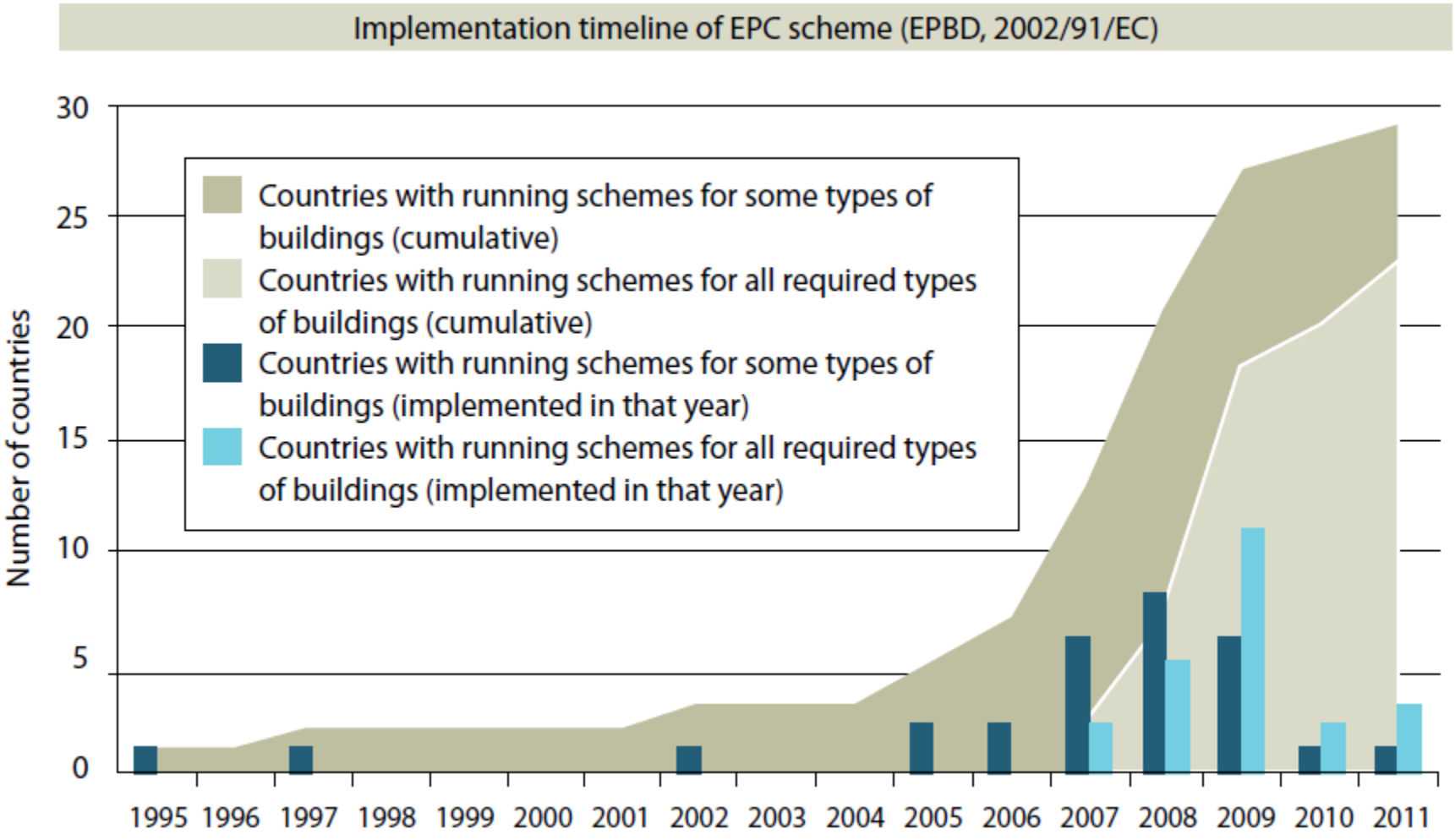
1. Introduction



1. Introduction

Overall results to 2050

Source: BPIE model

Scenario		0	1A	1B	2	3	4
Description		Baseline	Slow & Shallow	Fast & Shallow	Medium	Deep	Two- stage
Annual energy saving in 2050	TWh/a	365	1,373	1,286	1,975	2,795	2,896
2050 saving as % of today	%	9%	34%	32%	48%	68%	71%

1. Introduction

DIRECTIVE 2010/31/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 19 May 2010

on the energy performance of buildings

(recast)

Article 1

Subject matter

1. This Directive promotes the improvement of the energy performance of buildings within the Union, taking into account outdoor climatic and local conditions, as well as indoor climate requirements and cost-effectiveness.

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1. Introduction

DIRECTIVE 2010/31/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 19 May 2010

on the energy performance of buildings

(recast)

Article 7

Existing buildings

Member States shall take the necessary measures to ensure that when buildings undergo major renovation, the energy performance of the building or the renovated part thereof is upgraded in order to meet minimum energy performance requirements set in accordance with Article 4 in so far as this is technically, functionally and economically feasible.

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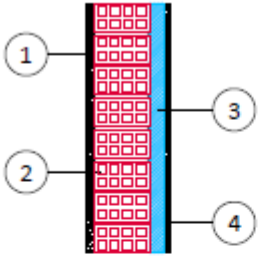
2. Changes in the building sector following the implementation of EC 2002/91 in Cyprus

- **Building shell insulation**
- **Improvement of building services**
- **Promotion of environmental design of buildings**
- **Promotion of renewable energy technologies**

2. Best practices in the building renovation sector

Building Shell Insulation



① Σοβάς 25 mm
② Τούβλο 200 mm
③ Εξηλασμένη πολυστερίνη 50 mm
④ Σοβάς 25 mm

ΥΠΟΛΟΓΙΣΜΟΣ ΘΕΡΜΟΠΕΡΑΤΟΤΗΤΑΣ ΕΚΤΕΘΕΙΜΕΝΗΣ ΤΟΙΧΟΠΟΙΙΑΣ			
Ονομασία Υλικού (Ξεκινώντας από το Εσωτερικό)	**Πάχος d [m]**	**Θερμ. Αγωγιμότητα λ [W/mK]**	**Θερμ. Αντίσταση R [m²K/W]**
Σοβάς §1.5.2.3	0.025	1.0	0.025
Τούβλο §1.3.1	0.20	0.4	0.5
Εξ. Πολυστερίνη	0.05	0.035	1.428
Σοβάς §1.5.2.3	0.025	1.0	0.025
Εσωτερική Θερμική Αντίσταση Rsi [m²K/W]			0.13
Εξωτερική Θερμική Αντίσταση Rse [m²K/W]			0.04
Θερμοπερατότητα Εκτεθειμένης Τοιχοποιίας [W/m²K]	**0.465**		
Πληρεί την ελάχιστη νομοθετική απαίτηση (< 0.85 W/m²K)			

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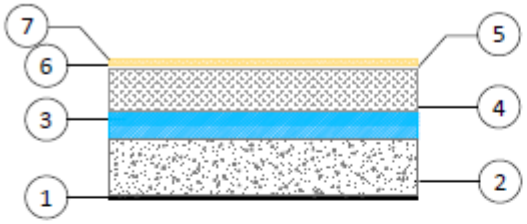
2. Best practices in the building renovation sector

Building Shell Insulation



1. Σπάτουλα 10 mm
2. Οπλισμένο Σκυρόδεμα 2% 200 mm
3. Εξηλασμένη πολυστερίνη 100 mm
4. Οπλισμένο Screed 150 mm
5. Τσιμεντοειδής υγρομόνωση 10 mm
6. Γόμα 5 mm
7. Κεραμικό 20 mm

ΥΠΟΛΟΠΙΣΜΟΣ ΘΕΡΜΟΠΕΡΑΤΟΤΗΤΑΣ ΕΚΤΕΘΕΙΜΕΝΗΣ ΟΡΟΦΗΣ			
Ονομασία Υλικού (Ξεκινώντας από το Εσωτερικό)	Πάχος d [m]	Θερμ. Αγωγιμότητα λ [W/mK]	Θερμ. Αντίσταση R [m²K/W]
Σπάτουλα §1.5.2.3	0.01	1.0	0.01
Οπλισμένο Σκυρόδεμα 2% §1.6.1.4	0.20	2.5	0.08
Εξ. Πολυστερίνη §7.9	0.1	0.03	3.33
Οπλ. Screed §1.6.1.3	0.15	2.3	0.065
Τσιμεντοειδής υγρομόνωση §1.6.2.1.3	0.01	0.23	0.043
Γόμα	0.005	-	-
Κεραμικό §14.2.1	0.02	1.3	0.015
Εσωτερική Θερμική Αντίσταση Rsi [m²K/W]			0.1
Εξωτερική Θερμική Αντίσταση Rse [m²K/W]			0.04
Θερμοπερατότητα Εκτεθειμένης Οροφής [W/m²K]	0.271		
Πληρεί την ελάχιστη νομοθετική απαίτηση (< 0.75 W/m²K)			

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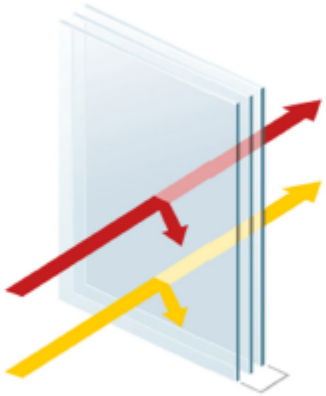
2. Best practices in the building renovation sector

Building Shell Insulation

LIGHT	
Transmission	74
Reflection	20

ENERGY	
Solar factor	70
Energy Reflection	17



THERMAL PROPERTIES (EN 673)	EN 673
Ug-Value - W/(m².K)	1.8

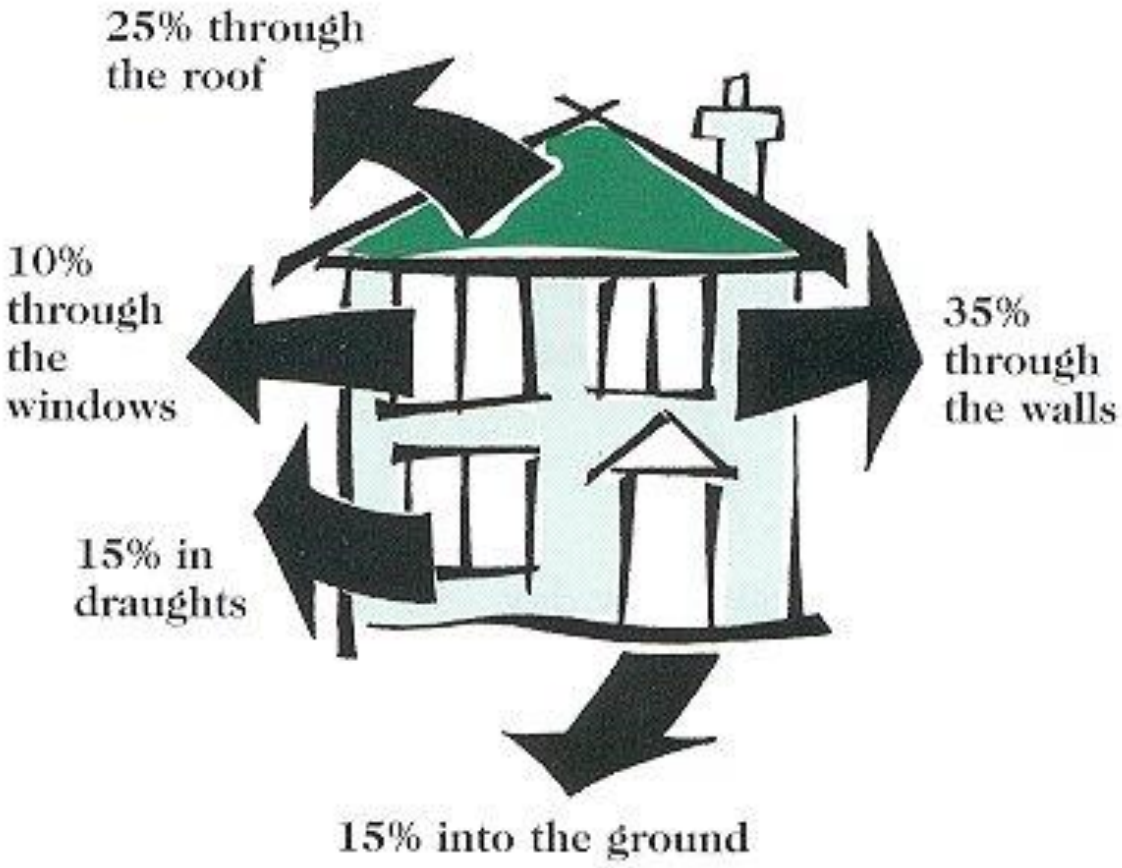
LIGHT PROPERTIES (EN 410)	EN 410
Light Transmission - τv (%)	74
Light Reflection - ρv (%)	20
Colour Rendering - RD65 - Ra (%)	97

ENERGY PROPERTIES	EN 410	ISO 9050
Solar factor - g (%)	70	69
Energy Reflection - ρe (%)	17	17
Direct Energy Transmission - τe (%)	62	61
Solar abs. Glass 1 - αe (%)	9	9
Solar abs. Glass 2 - αe (%)	7	7
Solar abs. Glass 3 - αe (%)	5	5
Total Energy absorption - αe (%)	21	21
Shading coefficient - SC	0.8	0.79
UV Transmission - UV (%)	38	
Schattenfaktor (DE) - b-Faktor		86.0

OTHER PROPERTIES	
Resistance to fire - EN 13501-2	NPD
Reaction to fire - EN 13501-1	NPD
Bullet Resistance - EN 1063	NPD
Burglar Resistance - EN 356	NPD
Pendulum body impact resistance - EN 12600	NPD / NPD / NPD
Direct airborne sound insulation(Rw (C;Ctr) - ESTIMATED) - dB	32 (-1, -6)

2. Best practices in the building renovation sector

Building Shell Insulation



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2. Best practices in the building renovation sector

Building Shell Insulation

Z16	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Nov 1300 COOLING OA DB / WB 29.2 °C / 16.8 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 1.7 °C / -1.4 °C		
	OCCUPIED T-STAT 23.9 °C			OCCUPIED T-STAT 21.1 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	4 m²	1091	-	4 m²	-	-
Wall Transmission	7 m²	1	-	7 m²	47	-
Roof Transmission	5 m²	0	-	5 m²	49	-
Window Transmission	4 m²	27	-	4 m²	182	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	12 m²	0	-	12 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	0 W	0	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	1120	0	-	278	0

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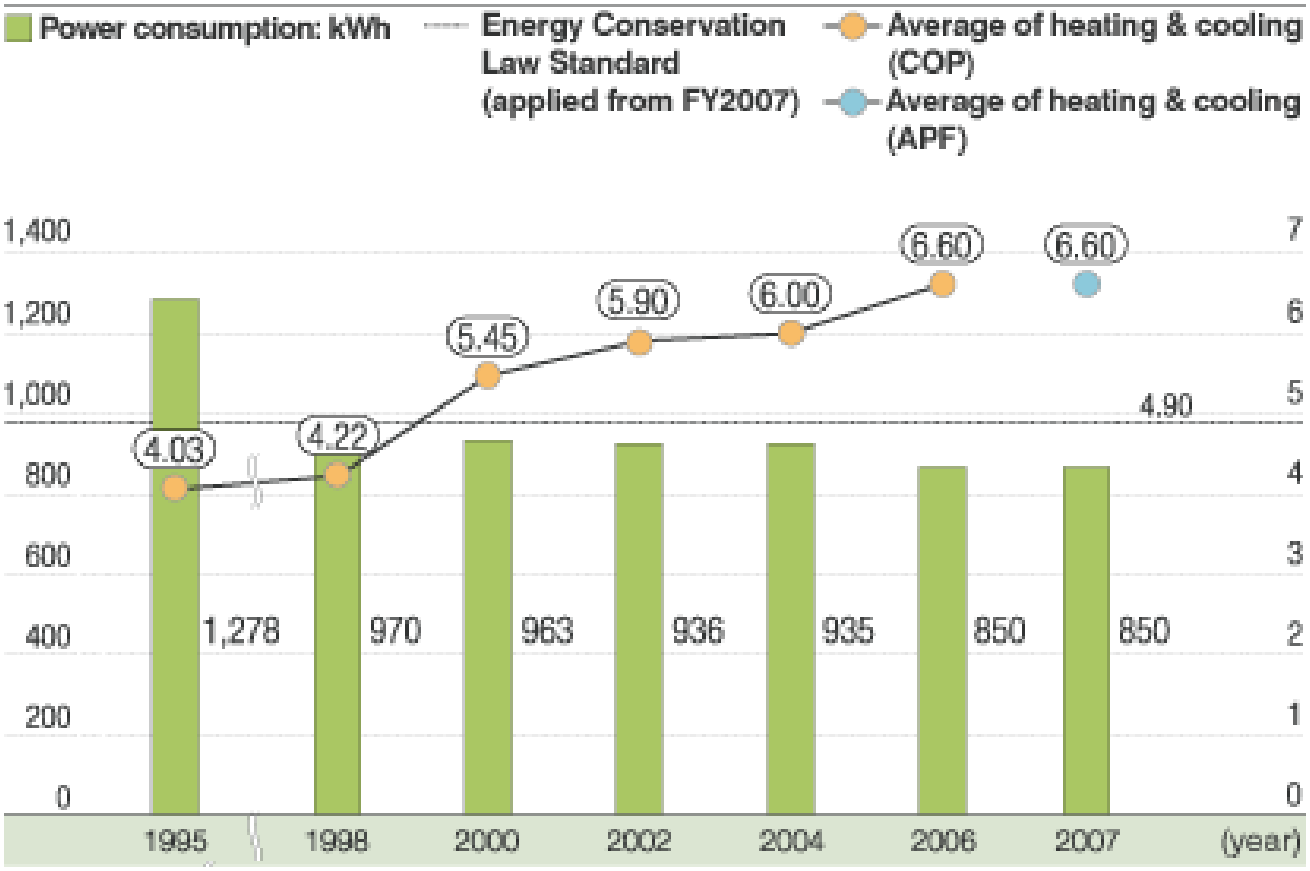
2. Best practices in the building renovation sector

Improvement of building services



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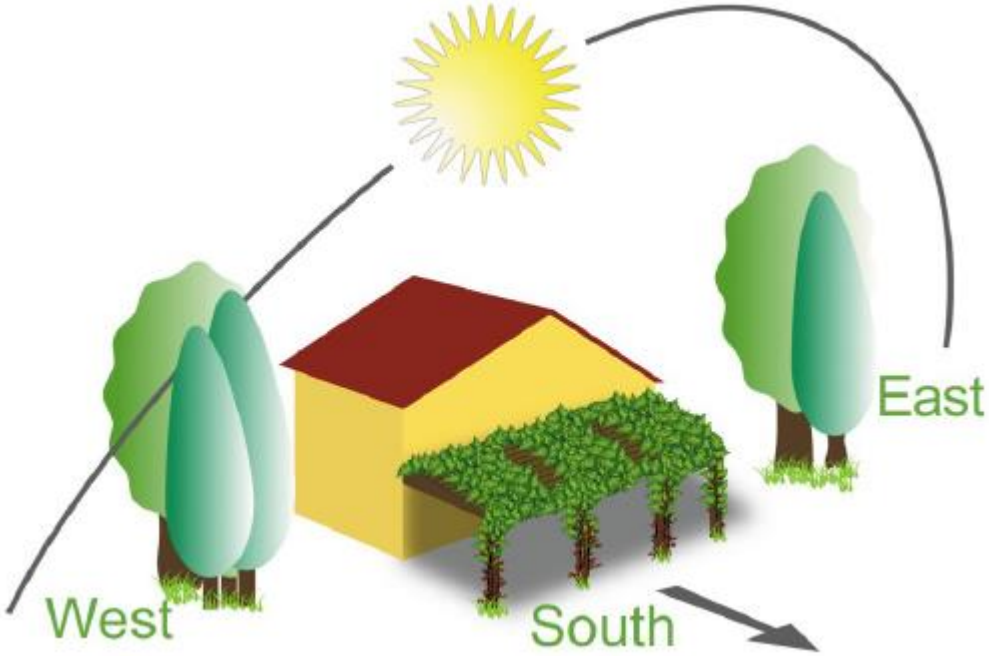
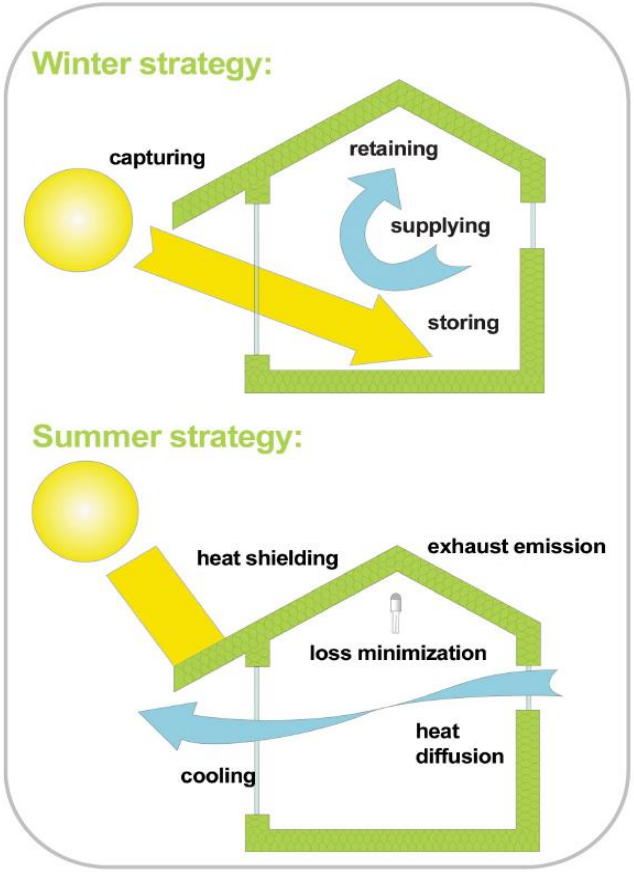
2. Best practices in the building renovation sector

Promotion of environmental design of buildings





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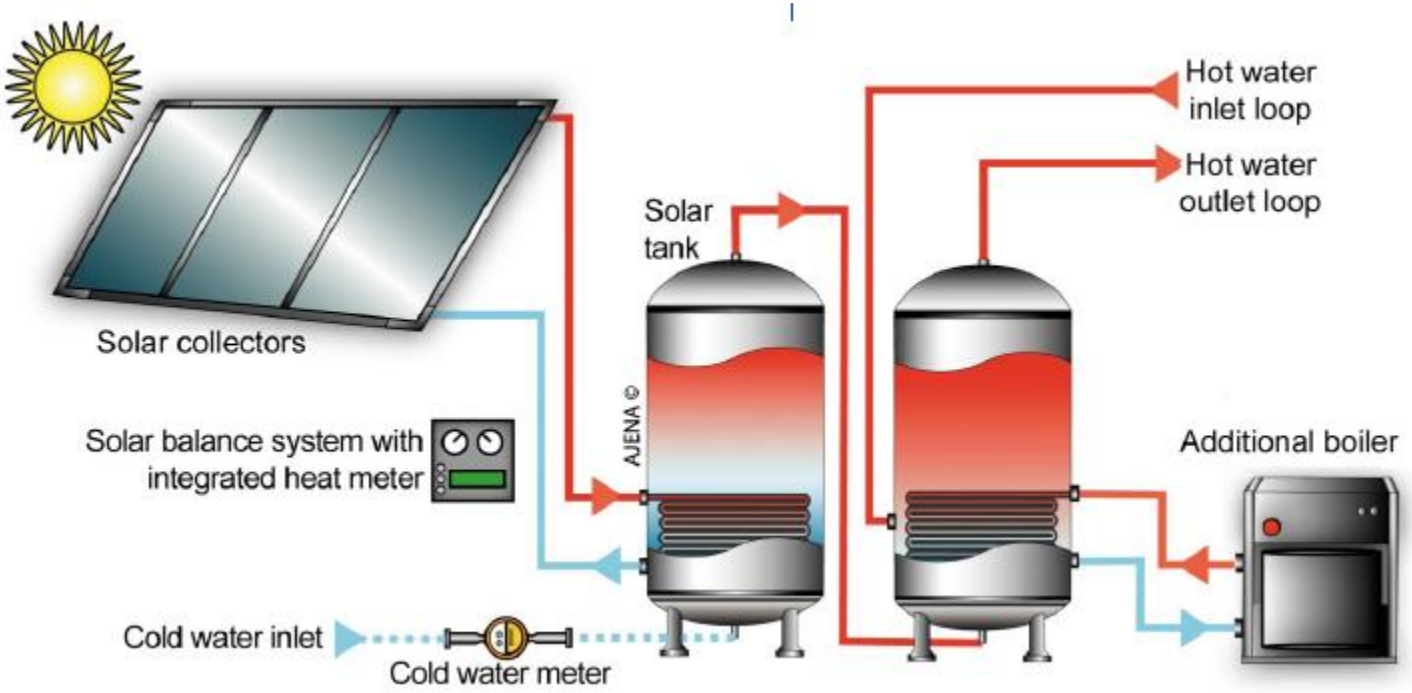
2. Best practices in the building renovation sector

Promotion of renewable energy technologies



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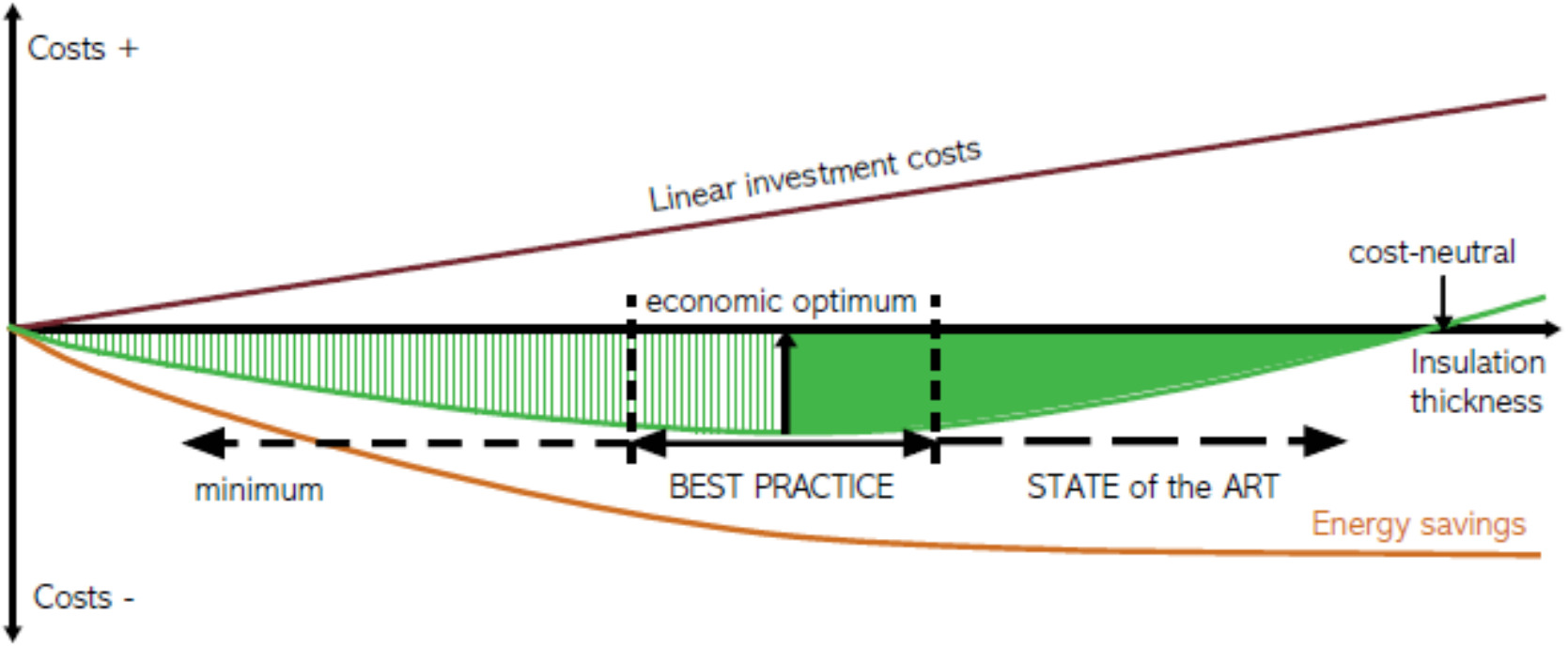
3. Further steps towards 2020 goals

- **Introduction of technoeconomical aspect as a design tool in decision making**
- **Further reduction of energy performance minimum requirements**
- **Establishment of building energy audits**
- **The role of education and research**

3. Further steps towards 2020 goals

Technoeconomical Aspect

Figure 2: Position of the economic optimum



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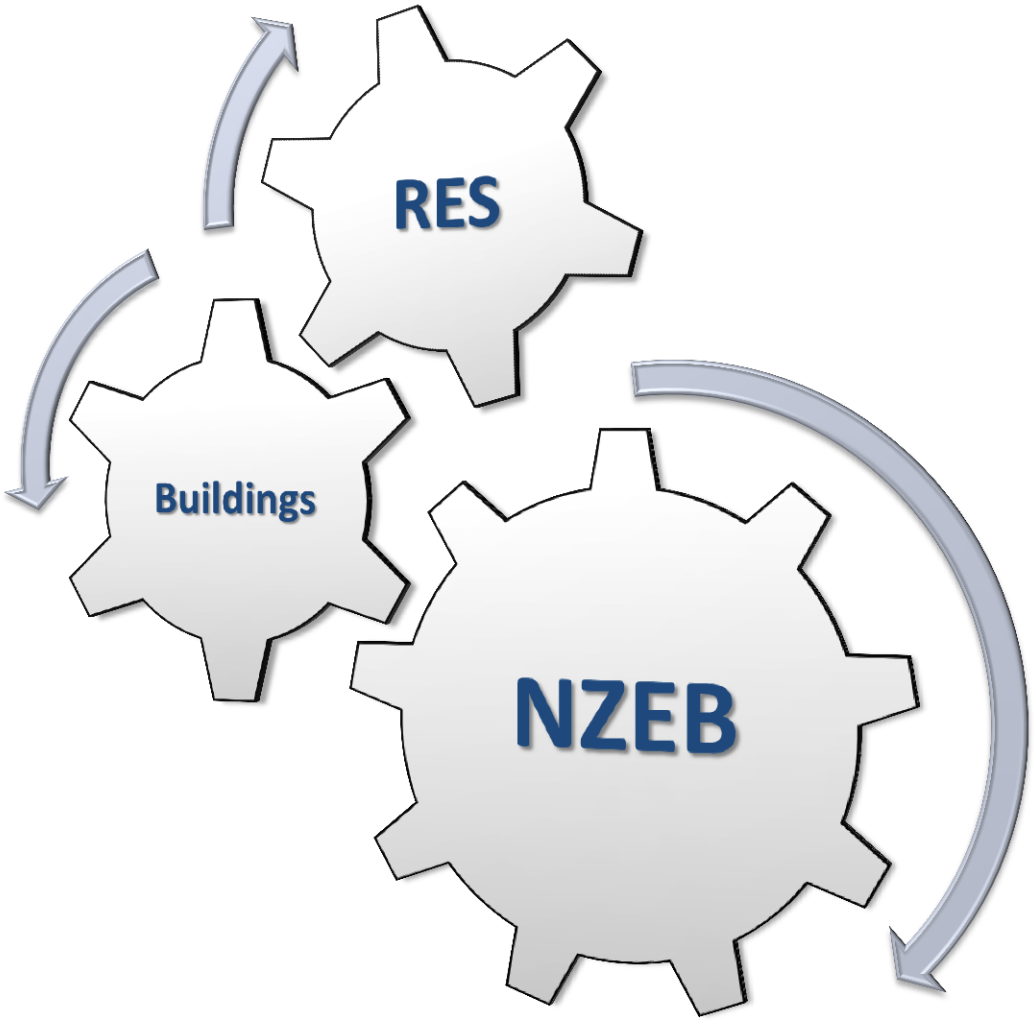
3. Further steps towards 2020 goals

Minimum requirements



3. Further steps towards 2020 goals

Building energy audits

"If you cannot measure it, you cannot improve it"

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3. Further steps towards 2020 goals

Education and Research

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4. Q+A

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